



# Petersburg Medical Center

## Seismic Evaluation Report

July 2019





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# 1. Executive Summary

## OVERVIEW

KPFF Consulting Engineers (KPFF) performed a seismic evaluation of the Petersburg Medical Center using American Society of Civil Engineers Standard 41-13 (ASCE 41). There were building components that were flagged as noncompliant per the Tier 1 checklists found in ASCE 41. This report summarizes the Tier 1 evaluation performed by KPFF and could be used as the basis for future evaluation of the structure.

## BACKGROUND

The Petersburg Medical Center consists of three buildings: the Long Term Care Wing constructed in 1967, the Hospital building constructed in 1983, and a Clinic constructed in the 1990s. The Long Term Care Wing is a two-story building, with an attic that was added in 1983. The lateral force-resisting system consists of concrete shear walls. The Hospital building is a two-story building with an attic. Its lateral force-resisting system consists of steel moment frames. The Clinic consists of wood-framed modules on a concrete base. The Clinic was probably designed according to the 1991 Uniform Building Code (UBC), which is prior to the edition of the UBC that would enable this building to satisfy the benchmark provisions of ASCE 41, so that a seismic evaluation need not be performed. Construction drawings for the Clinic were not available, and it is not included in this seismic evaluation.

## SEISMIC EVALUATION

KPFF performed a Tier 1 evaluation of the structures in accordance with ASCE 41. A Tier 1 evaluation is an initial screening of a building for potential seismic deficiencies in the event of an earthquake of specified intensity. Items found noncompliant with the requirements of the Tier 1 evaluation trigger a Tier 2 deficiency-based analysis to determine whether the structural component is deficient and requires strengthening, or if the calculated capacity of the component is sufficient to meet ASCE 41 Tier 2 requirements. No Tier 2 evaluations were performed, as they were beyond the scope of this study.

KPFF evaluated the seismic structural systems of the Long Term Care Wing and the Hospital building for a Target Building Performance Level of I-B, Immediate Occupancy, and the corresponding Structural Performance Level of S-1. This Target Building Performance Level, which is applicable to buildings considered to be essential facilities, corresponds to a building seismic response where only limited structural damage has occurred. Continued use of the building may be limited by damage or disruption to nonstructural elements, such as light fixtures, plumbing, and equipment. Evaluation of these nonstructural elements was not included in this study.

Seismic demands were evaluated using a Basic Safety Earthquake-1 for existing buildings (BSE-1E). This corresponds to a lower seismic hazard level than would be used for new construction (BSE-1N) of a similar building. Traditionally, existing buildings have been evaluated at this somewhat reduced seismic hazard level, for reasons described in Section C2.2.1 of ASCE 41.

## 2. Building Description

Petersburg Medical Center is located in Petersburg, Alaska, in the city block bounded by First Street, North Second Street, Excel Street, and Fram Street. The medical center consists of the main hospital, a long term care wing, and a clinic. The original hospital building, built in the northeast corner of the block in 1955, has been demolished. See Figure 2-1 below for a plan of the facility layout.

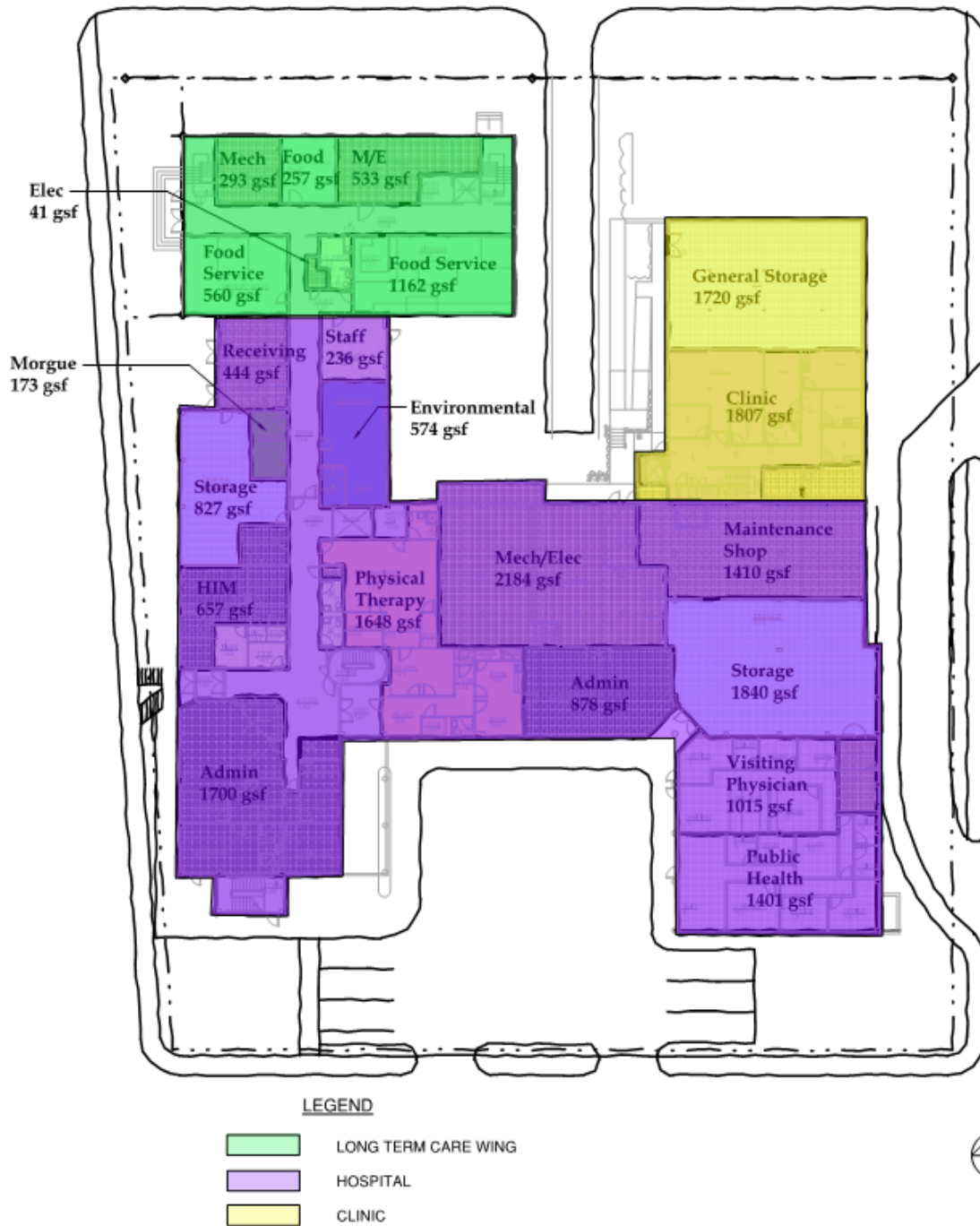


Figure 2-1: Building Layout Plan



The Long Term Care Wing was built as an addition to the original hospital building in 1967. It was constructed as a two-story building. An attic was added on top of the building when the Hospital was built in 1983.

The attic framing consists of a combination of WT's and Z-purlins at the roof and light gage channel purlins at the attic floor spanning to trusses. The trusses span to the exterior concrete walls. The trusses are composed of wide flange top and bottom chords with steel pipe diagonals. At limited areas of the attic floor, there is concrete slab on steel form deck for equipment support and to provide a walking surface within the attic. There is no structural steel deck at the attic roof or floor, except for the areas with concrete slab. The attic floor at this building is located just above the original concrete roof slab.

The foundation system for the Long Term Care Wing consists of cedar piling. The piles are battered underneath the exterior concrete walls in the direction parallel to the plane of the wall. The exterior grade is at or near the first floor elevation.

[illegible]

**Figure 2-2: Long Term Care Wing Floor Plan**

## HOSPITAL

The Hospital building is a two-story building with an attic that was built in 1983. Originally, the southwest area of the first floor was covered parking. This area was later enclosed.

The first floor of the Hospital consists of concrete slabs-on-grade. The second floor consists of reinforced concrete slabs spanning to composite-designed steel beams and girders, which are supported by steel wide flange columns. The attic framing consists of a combination of WTs and Z-purlins at the roof and wide flanges and light gage channel purlins at the attic floor spanning to trusses. The trusses span to the exterior steel wide flange columns. The trusses are composed of wide flange top and bottom chords with steel pipe diagonals. At limited areas of the attic floor there is concrete slab on steel form deck for equipment support and to provide a walking surface within the attic. There is no structural steel deck at the attic roof or floor, except for the areas with concrete slab.

The lateral force-resisting system for the Hospital consists of steel moment-resisting frames. The specific bays of steel moment frame are not clearly defined on the structural drawings, and are generally assumed to occur where the framing matches or is similar to the limited locations where the steel moment frame details are indicated on the framing plans. The concrete slabs at the second floor act as rigid diaphragms distributing lateral loads to the moment frames. At the attic floor and roof there are light gage diagonal channels laid flat adjacent to the attic floor and roof framing members to serve as horizontal bracing to the exterior moment frames.

The foundation system for the Hospital consists of concrete spread footings. Continuous concrete grade beams act as continuous spread footings at the grids with steel moment frames. The exterior grade transitions from the first floor to the second floor from the southeast corner to the northeast corner of the Hospital. It transitions back down to the first floor within a short distance along the north elevation of the Hospital from the northeast corner.

Figure 2-3 shows the second floor framing plan of the Hospital.

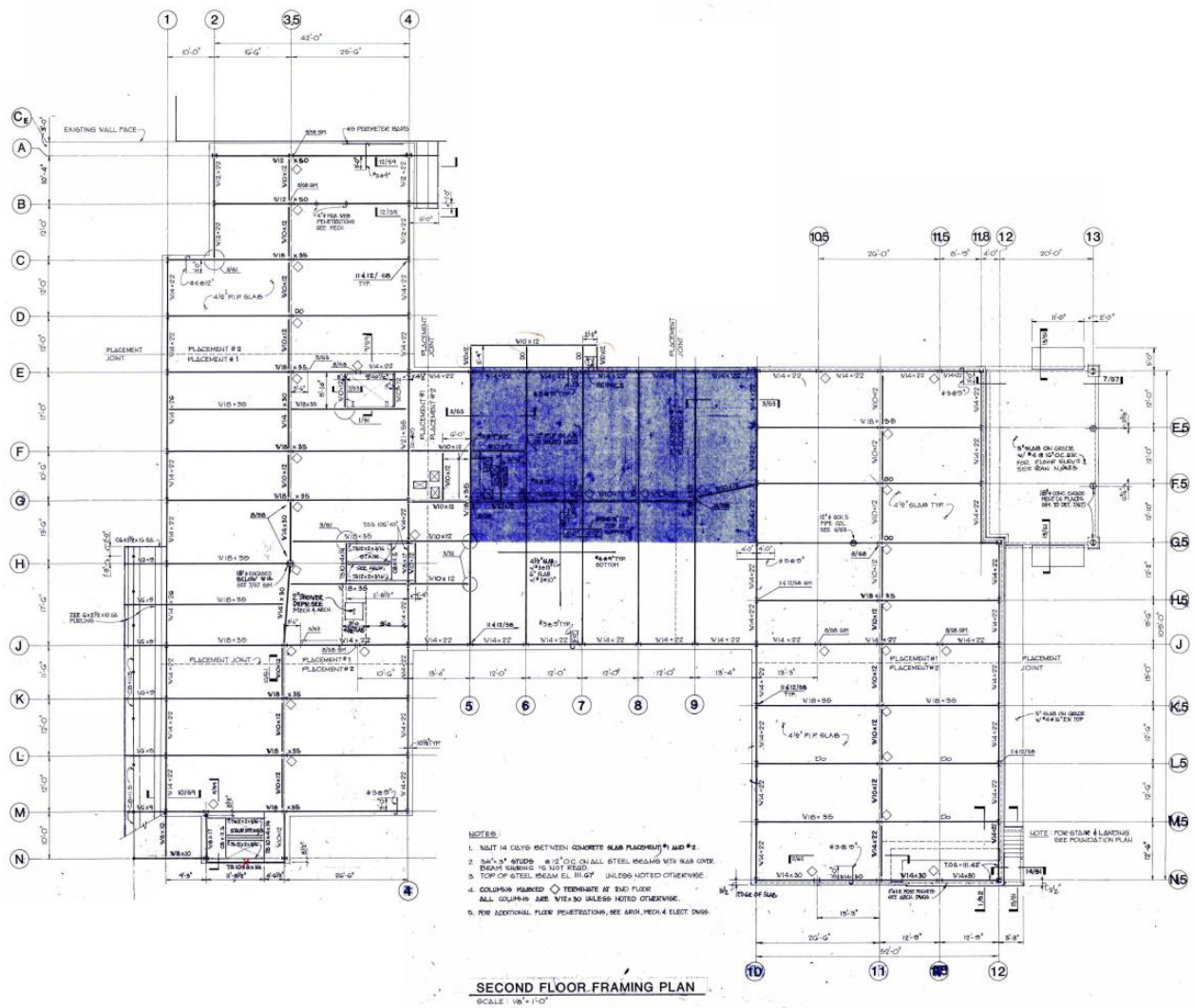


Figure 2-3: Hospital Floor Plan

## BUILDING CONDITIONS

During KPFF's site visit in June 2019, the condition of the structural systems that could be observed appeared to be in good repair. No damage to the structural systems was noted. At the Long Term Care Wing, some additional openings in the exterior concrete walls had been added for windows, doors, or louvers. These additional openings were considered in the seismic evaluation.

Minor settlement of the exterior stair on the west side of the building relative to the building was noted at the Long Term Care Wing. See Figure 2-4. If these concrete stairs are supported on spread footings, whereas the building is pile supported, that could account for the settlement.

The cladding at the sun room at the west side of the Long Term Care Wing is damaged, likely due to weather and water penetration issues. See Figure 2-5. There is no apparent damage to the building structure in this area.

Minor cracking was observed in some exposed exterior concrete walls. At some locations, this cracking appeared to coincide with construction joint locations. The cracking is not considered to be evidence of any structural issues.



Figure 2-4: Settlement at Long Term Care Wing Exterior Stair



Figure 2-5: Cladding Damage at Long Term Care Wing Exterior Sun Room

### 3. ASCE 41 Tier 1 Seismic Evaluation

ASCE 41 provides a three-tiered evaluation approach: a Screening Phase (Tier 1), an Evaluation Phase (Tier 2), and a Detailed Evaluation Phase (Tier 3). A Tier 1 evaluation consists of checklists that allow for a rapid evaluation of the structural elements of the building and site conditions. The purpose of the Tier 1 procedure is to screen building components per the provisions of ASCE 41 to identify potential deficiencies. If non-compliant checklist items are identified for a building during the Tier 1 evaluation, a Tier 2 Deficiency-Based Evaluation is required for further evaluation. Tier 3 includes a more detailed evaluation of deficiencies. Neither a Tier 2 nor Tier 3 evaluation was within the scope of this study.

#### **ASSESSMENT CRITERIA**

Earthquake accelerations for use in ASCE 41 seismic evaluation are based on data provided by the United States Geological Survey (USGS) and are adjusted for site-specific soil conditions. Table 3-1 lists the acceleration response spectrum parameters for both the Basic Safety Earthquake-1 for new construction (BSE-1N) and for the Basic Safety Earthquake-1 for existing construction (BSE-1E). The BSE-1N values were used solely to determine the Level of Seismicity at the building site (High, Moderate, Low, or Very Low Seismicity) in accordance with Section 2.5 of ASCE 41. The BSE-1E values were used to evaluate seismic demands on the structure when evaluating the Tier 1 checklists. See Appendix C for a summary of the USGS seismic hazard parameters for the BSE-1N and BSE-1E earthquakes at this site.



**Table 3-1: Spectral Response Acceleration Values for BSE-1N and BSE-1E**

Spectral Response Acceleration Parameter	BSE – 1N	Spectral Response Acceleration Parameter	BSE – 1E
$S_{DS}$	0.299 g	$S_{XS}$	0.197 g
$S_{D1}$	0.342 g	$S_{X1}$	0.267 g

The site soil properties were assumed to be such that the site would be classified as Site Class D. This is the default site classification if soil properties are not known in sufficient detail to determine the site class. Based on the acceleration parameters, this site is classified as having a high level of seismicity.

The Hospital building is considered an essential facility, and is therefore categorized as Risk Category IV per the 2015 International Building Code. Due to its potential use as part of the hospital environment, it was determined that the Long Term Care Unit would also be considered an essential facility and be categorized as Risk Category IV. Table 2-1 of ASCE 41 states that buildings categorized as Risk Category IV for the Tier 1 evaluation shall use Immediate Occupancy Performance Level checklists.

## BUILDING TYPE AND CHECKLISTS

The Tier 1 screening was conducted with the appropriate hazard checklists, based on the building type, the level of seismicity, and the required level of performance. The descriptions associated with each building type are found in ASCE 41. The Long Term Care Unit is classified as Type C2 for concrete shear walls with stiff diaphragms, and Type S4 for the attic framing with its steel, horizontally braced diaphragm system. The checklists used in the Tier 1 evaluation are listed below in Table 3-2. Refer to Appendix B for the completed checklists.

**Table 3-2: Required Checklists for Tier 1 Evaluation**

Required Tier 1 Checklist	ASCE 41 Reference
1. Basic Configuration – Immediate Occupancy	Section 16.1.2IO
2. Long Term Care Wing: Building Type C2 – Immediate Occupancy	Section 16.10IO
3. Long Term Care Wing: Building Type S4 – Immediate Occupancy	Section 16.7IO
4. Hospital: Building Type S1 – Immediate Occupancy	Section 16.4IO

## INFORMATION COLLECTED

KPFF reviewed the original construction drawings by Olsen and Sands for the Long Term Care Wing, dated August 1967, and the original construction drawings by Ackley Jensen for the Hospital and the addition of the attic to the Long Term Care Wing, dated April 1983. The Long Term Care Wing building was designed according to the 1967 Uniform Building Code, and the Hospital building was designed according to the 1979 Uniform Building Code.

Documentation defining the geologic site hazards was not available. However, a report by the United States Department of the Interior Geological Survey, "Reconnaissance Engineering Geology of the Petersburg Area, Southeastern Alaska, with Emphasis on Geologic Hazards," dated 1978, was available from the Alaska Division of Geological and Geophysical Surveys. This report noted a low likelihood of liquefaction, slope failures, or surface fault ruptures in Petersburg, and was used as the basis for the geologic site hazard responses indicated in the checklists.

A site visit was conducted on June 18, 2019, to identify variances between the record drawings and the visible building structures, as well as to observe the condition of the buildings.

## POTENTIAL SEISMIC DEFICIENCIES

The Tier 1 checklist identifies building components that may be deficient in an earthquake based on the specific building type, the level of seismicity in the region, and the desired level of performance. The completed Tier 1 checklists are included in Appendix B. A summary of noncompliant items is listed below.

### Long Term Care Wing

- **Building Type C2 - Foundation Dowels:** Concrete shear wall vertical reinforcement dowel embedment lengths into the foundations are less than that required to develop the strength of the walls. For reference, see Section F/S-3 shown in Appendix A, Figure A1.
- **Building Type C2 - Deep Foundations/Connections:** Cedar pile tension capacities unknown. No tension connection between piles and pile caps to resist uplift. No top reinforcement in pile caps. For reference, see Section 1E/S-2 shown in Appendix A, Figure A2.
- **Building Type S4 – Connections:** Attic horizontal bracing system has insufficient capacity to transfer lateral forces to concrete shear walls.

### Hospital

- **Basic Configuration – Load Path:** Steel moment frame locations unclear. Some areas of the building do not have a complete, well-defined load path to the steel moment frames. The diaphragm at the attic level is incomplete.
- **Building Type S1 – Drift Check:** Some of steel moment frames do not meet the drift limit.
- **Building Type S1 – Transfer to Steel Frames:** Attic horizontal bracing system has insufficient capacity to transfer lateral forces to steel moment frames.
- **Building Type S1 – Steel Columns:** Connections of moment frame columns to foundations insufficient to develop tensile capacity of columns. For reference, see Section 4/S-7 shown in Appendix A, Figure A3.
- **Building Type S1 – Moment-Resisting Connections:** Based on information provided on the drawings, it cannot be verified and is considered unlikely that moment frame connections are able to develop the strength of the beams. For reference, see Sections 11/S-8 and 12/S-8 shown in Appendix A, Figure A4.
- **Building Type S1: Compact Members:** Moment frame members do not meet compact section requirements.
- **Building Type S1: Girder Flange Continuity Plates:** There are no girder flange continuity plates at the moment frame joints. For reference, see Sections 11/S-8 and 12/S-8 shown in Appendix A, Figure A4.

- **Building Type S1:** Bottom Flange Bracing: Moment frame beam flanges are not braced out-of-plane at the attic level.
- **Building Type S1 – Plan Irregularities:** Based on the information provided on the drawings, there may be insufficient tensile capacity in the steel framing and connections to develop the diaphragm tensile forces at floor- and attic-level re-entrant corners.

ASCE 41 also includes an extensive checklist for nonstructural components, such as HVAC equipment and systems, ceilings, and cladding, particularly for a Risk Category IV facility like a hospital. These nonstructural components were not reviewed as part of this seismic evaluation. However, given when these systems were constructed, it is expected that many of the nonstructural components would not be compliant.

## 4. Conclusions

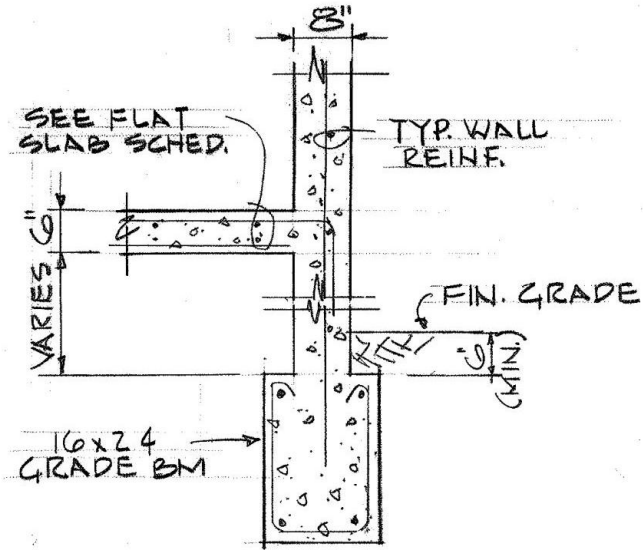
It was found that the Long Term Care Wing and the Hospital building have noncompliant components according to an ASCE 41 Tier 1 evaluation. These noncompliant components are mainly related to the concrete shear wall foundations at the Long Term Care Wing, the steel moment frames at the Hospital building, and the attic diaphragms at both buildings. A Tier 2 or Tier 3 evaluation would be required for further review of these components, but it is expected that some components would still be determined to be deficient and would require strengthening and/or retrofitting. In addition, it is expected that some of the nonstructural building components would also require retrofitting or replacement.



# Appendix A

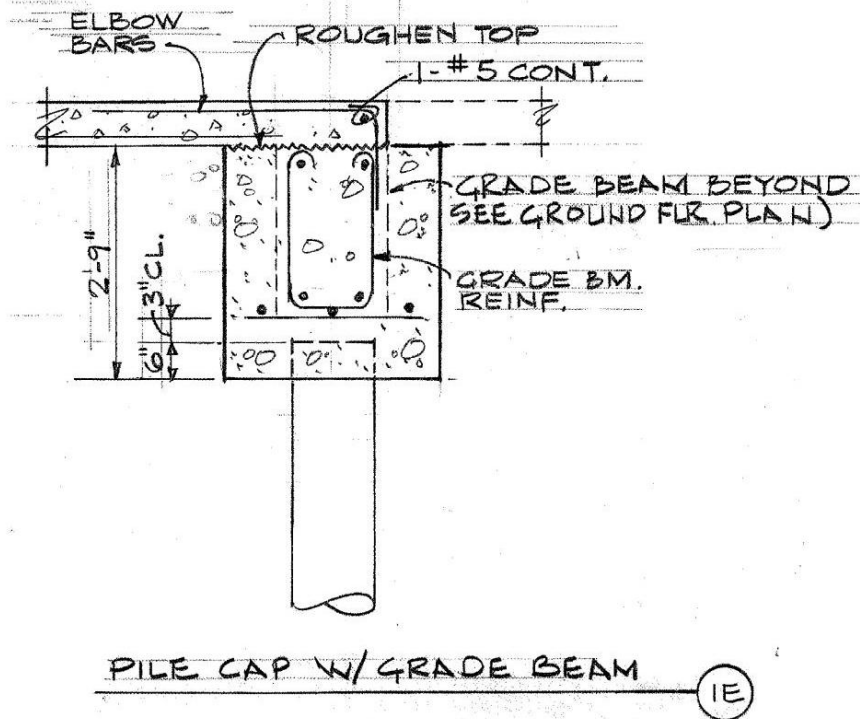
Figures





SECTION F  
 $\frac{1}{2}'' = 1'-0''$

Figure A1: Long Term Care Wing – Foundation Dowels (Section F/S-3)



PILE CAP W/ GRADE BEAM  
 IE

Figure A2: Long Term Care Wing – Deep Foundations/Connections (Section 1E/S-2)

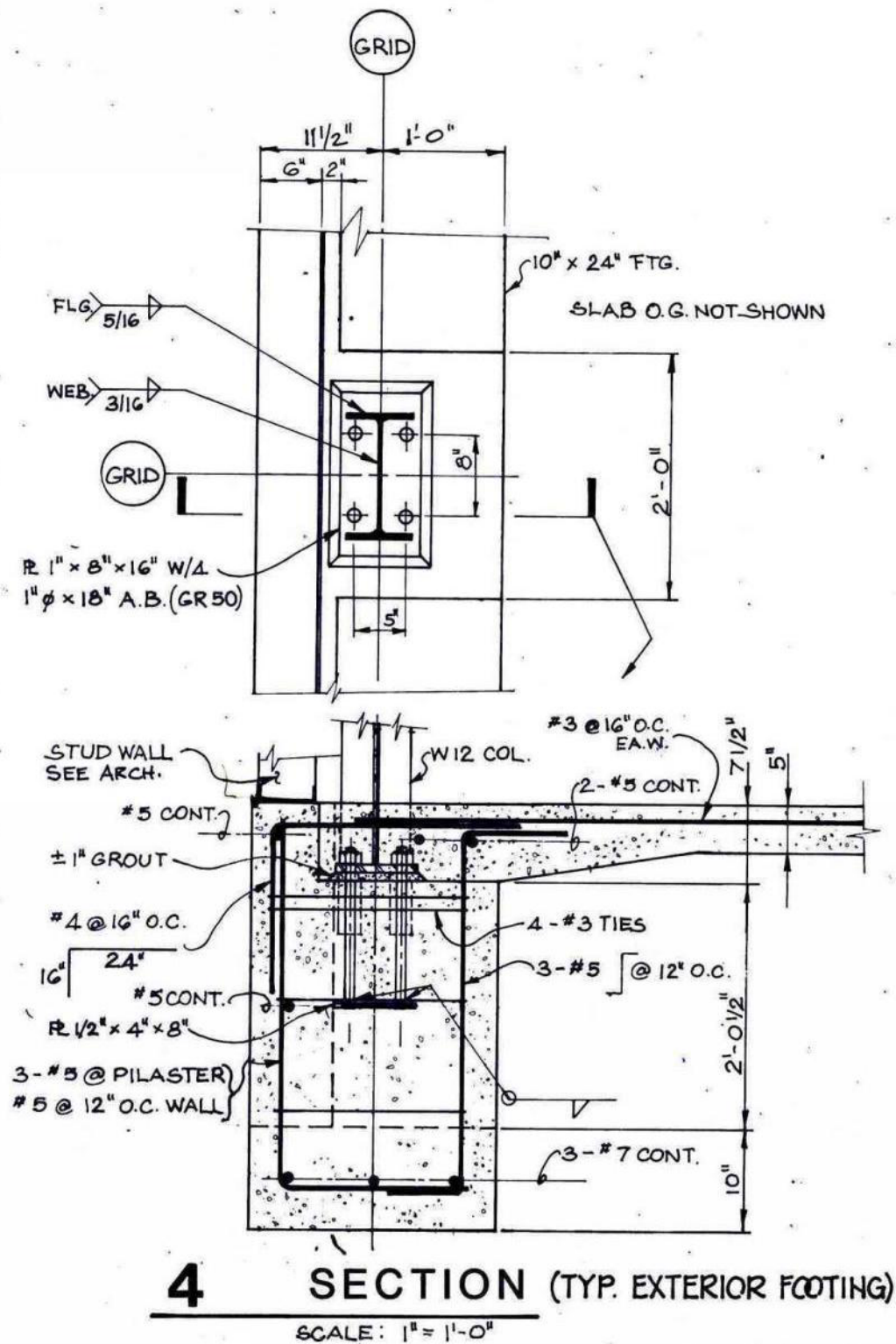


Figure A3: Hospital – Steel Columns (Section 4/S-7)

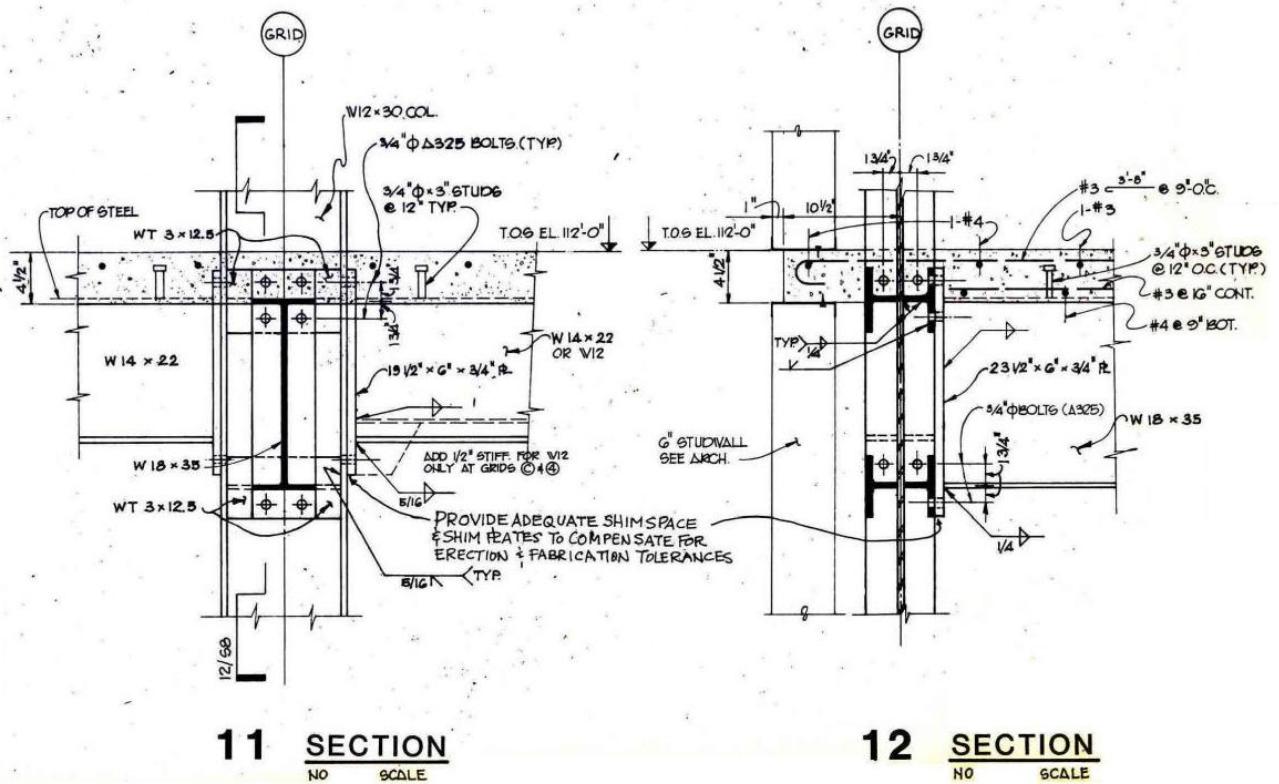


Figure A4: Hospital – Moment-Resisting Connections/Girder Flange Continuity Plates (Section 11/S-8 and 12/S-8)



# Appendix B

## Tier 1 Checklists

Refer to the following pages for Tier 1 Checklists associated with our study of the Petersburg Medical Center. Tier 1 Checklists were based on Immediate Occupancy Structural Performance Level (S-1). Each of the evaluation statements are marked as follows:

C – Compliant

NC – Noncompliant

N/A – Not Applicable

U – Unknown





## **Very Low Seismicity**

### **Building System**

#### *General*

(C)	NC	N/A	U	LOAD PATH: The structure shall contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)
(C)	NC	N/A	U	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement need not apply for the following building types: W1, W1A, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)
C	NC	(N/A)	U	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)

#### *Building Configuration*

(C)	NC	N/A	U	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction shall not be less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)
(C)	NC	N/A	U	SOFT STORY: The stiffness of the seismic-force-resisting system in any story shall not be less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)
(C)	NC	N/A	U	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)
(C)	NC	N/A	U	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)
(C)	NC	N/A	U	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)
(C)	NC	N/A	U	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)

**Low Seismicity**      *(Complete the following items in addition to the items for Very Low Seismicity)*

**Geologic Site Hazards**

- |     |    |     |   |  |
|-----|----|-----|---|--|
| (C) | NC | N/A | U | LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building. (Commentary: Sec. A.6.1.1. Tier 2: Sec. 5.4.3.1)           |
| (C) | NC | N/A | U | SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: Sec. 5.4.3.1) |
| (C) | NC | N/A | U | SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: Sec. 5.4.3.1)   |

**Moderate and High Seismicity**      *(Complete the following items in addition to the items for Very Low and Low Seismicity)*

**Foundation Configuration**

- |     |    |     |   |   |
|-----|----|-----|---|---|
| (C) | NC | N/A | U | OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$ . (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)                         |
| (C) | NC | N/A | U | TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4) |

**IMMEDIATE OCCUPANCY –  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE C2 AND TYPE C2A**

Building: PETERSBURG MCMP - LTC  
KPFF Project No.: 1900308

**Very Low Seismicity**

**Seismic-Force-Resisting System**

- |     |    |     |   |   |
|-----|----|-----|---|---|
| (C) | NC | N/A | U | COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)  |
| (C) | NC | N/A | U | REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)  |
| (C) | NC | N/A | U | SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 psi or $2\sqrt{f'_c}$ . (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)   |
| (C) | NC | N/A | U | REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 inches. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3) |

**Connections**

- |     |      |       |   |   |
|-----|------|-------|---|---|
| C   | NC   | (N/A) | U | WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1) |
| (C) | NC   | N/A   | U | TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls and the connections are able to develop the lesser of the shear strength of the walls or diaphragms. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)  |
| C   | (NC) | N/A   | U | FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)  |

**Foundation System**

- |     |    |     |     |  |
|-----|----|-----|-----|--|
| C   | NC | N/A | (U) | DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil. (Commentary: Sec. A.6.2.3)                  |
| (C) | NC | N/A | U   | SLOPING SITES: The difference in foundation embedment depth from one side of the building to another shall not exceed one story high. (Commentary: Sec. A.6.2.4) |

**IMMEDIATE OCCUPANCY –  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE C2 AND TYPE C2A**

Building: PETERSBURG MCMP - LTC  
KPFF Project No.: 1900308

**Low, Moderate, and High Seismicity**

*(Complete the following items in addition to the items for Very Low Seismicity)*

**Seismic-Force-Resisting System**

C	NC	(N/A)	U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOK in the Immediate Occupancy Structural Checklist for Building Type C1. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)
(C)	NC	N/A	U	FLAT SLABS: Flat slabs/plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)
C	NC	(N/A)	U	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than $d/2$ and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)
(C)	NC	N/A	U	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered. (Commentary: Sec. A.3.2.2.4. Tier 2: Sec. 5.5.3.1.4)
(C)	NC	N/A	U	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$ . (Commentary: Sec. A.3.2.2.5. Tier 2: Sec. 5.5.3.2.2)
(C)	NC	N/A	U	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall. (Commentary: Sec. A.3.2.2.6. Tier 2: Sec. 5.5.3.1.5)
(C)	NC	N/A	U	WALL THICKNESS: Thickness of bearing walls are not less than $1/25$ the unsupported height or length, whichever is shorter, nor less than 4 inches. (Commentary: Sec. A.3.2.2.7. Tier 2: Sec. 5.5.3.1.2)

**Connections**

C	(NC)	N/A	U	UPLIFT AT PILE CAPS: Pile caps shall have top reinforcement and piles are anchored to the pile caps, and the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)
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**IMMEDIATE OCCUPANCY –  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE C2 AND TYPE C2A**

Building: PETERSBURG MCMP - LTC  
KPFF Project No.: 1900308

**Diaphragms (Flexible or Stiff)**

- |     |    |     |   |  |
|-----|----|-----|---|--|
| (C) | NC | N/A | U | DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)   |
| (C) | NC | N/A | U | OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)                                     |
| (C) | NC | N/A | U | PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. (Commentary: Sec. A.4.1.7. Tier 2: Sec. 5.6.1.4)      |
| (C) | NC | N/A | U | DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5) |

**Flexible Diaphragms**

- |   |    |       |   |  |
|---|----|-------|---|--|
| C | NC | (N/A) | U | CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)   |
| C | NC | (N/A) | U | STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)   |
| C | NC | (N/A) | U | SPANS: All wood diaphragms with spans greater than 12 feet consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)   |
| C | NC | (N/A) | U | DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 30 feet and aspect ratios less than or equal to 3-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2) |
| C | NC | (N/A) | U | NON-CONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 feet and have aspect ratios less than 4-to-1. (Commentary: Sec. A.4.3.1. Tier 2: Sec. 5.6.3)   |
| C | NC | (N/A) | U | OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)  |

**IMMEDIATE OCCUPANCY –  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S4**

Building: PETERSBURG MCMP - LTC ATTIC FRAMING  
KPFF Project No.: 1900308

**Very Low Seismicity**

**Seismic-Force-Resisting System**

<b>C</b>	NC	N/A	U	COLUMN AXIAL STRESS CHECK: The axial stress caused by gravity loads in frame columns subjected to overturning forces is less than $0.10F_y$ . Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.5.3.6, is less than $0.30F_y$ . (Commentary: Sec. A.3.1.3.2. Tier 2: Sec. 5.5.2.13.)
C	NC	<b>N/A</b>	U	BRACE AXIAL STRESS CHECK: The axial stress in the diagonal braces, calculated using the Quick Check procedure of Section 4.5.3.4 and neglecting the steel moment frame, is less than $0.50F_y$ . (Commentary: Sec. A.3.3.1.2. Tier 2: Sec. 5.5.4.1)
<b>C</b>	NC	N/A	U	COMPLETE FRAMES: Steel frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)
C	NC	<b>N/A</b>	U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3 and neglecting the steel moment frame, is less than the greater of 100 psi or $2\sqrt{f'_c}$ . (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)
C	NC	<b>N/A</b>	U	REINFORCING STEEL: The ratio of shear wall reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 inches. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)

**Connections**

C	NC	<b>N/A</b>	U	STEEL COLUMNS: The columns in seismic-force-resisting frames are anchored to the building foundation. (Commentary: Sec. A.5.3.1. Tier 2: Sec. 5.7.3.1)
C	<b>NC</b>	N/A	U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)
C	NC	<b>N/A</b>	U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)

**IMMEDIATE OCCUPANCY –  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S4**

Building: PETERSBURG MCMP - LTC ATTIC FRAMING  
KPFF Project No.: 1900308

**Low Seismicity**

*(Complete the following items in addition to the items for Very Low Seismicity)*

**Seismic-Force-Resisting System**

- |   |    |       |   |  |
|---|----|-------|---|--|
| C | NC | (N/A) | U | DRIFT CHECK: The drift ratio of the steel moment frames acting alone, calculated using the Quick Check procedure of Section 4.5.3.1 using 25% of $V_c$ , is less than 0.015. (Commentary: Sec. A.3.1.3.1. Tier 2: Sec. 5.5.2.1.2)                      |
| C | NC | (N/A) | U | REDUNDANCY: The number of lines of braced frames or shear walls in each principal direction is greater than or equal to 2. The number of braced bays in each line is greater than 3. (Commentary: Sec. A.3.2.1.1. and A.3.1.1.1. Tier 2: Sec. 5.5.1.1) |
| C | NC | (N/A) | U | INTERFERING WALLS: All concrete and masonry infill walls placed in moment frames are isolated from structural elements. (Commentary: Sec. A.3.1.2.1. Tier 2: Sec. 5.5.2.1.1)   |

**Connections**

- |   |    |       |   |   |
|---|----|-------|---|---|
| C | NC | (N/A) | U | TRANSFER TO STEEL FRAMES: Diaphragms are connected for transfer of seismic forces to the steel frames, and the connections are able to develop the lesser of the strength of the frames or the diaphragms. (Commentary: Sec. A.5.2.2. Tier 2: Sec. 5.7.2) |
|---|----|-------|---|---|

**Moderate Seismicity**

*(Complete the following items in addition to the items for Very Low and Low Seismicity)*

**Seismic-Force-Resisting System**

- |   |    |       |   |  |
|---|----|-------|---|--|
| C | NC | (N/A) | U | MOMENT-RESISTING CONNECTIONS: All moment connections are able to develop the strength of the adjoining members based on the specified minimum yield stress of the steel. (Commentary: Sec. A.3.1.3.4. Tier 2: Sec. 5.5.2.2.1). Note more restrictive requirements for High Seismicity. |
| C | NC | (N/A) | U | PANEL ZONES: All panel zones shall have the shear capacity to resist the shear demand required to develop 0.8 times the sum of the flexural strengths of the girders framing in at the face of the column. (Commentary: Sec. A.3.1.3.5. Tier 2: Sec. 5.5.2.2.2)                        |
| C | NC | (N/A) | U | COLUMN SPLICES: All column splice details located in moment frames include connection of both flanges and the web, and the splice develops the strength of the column. (Commentary: Sec. A.3.1.3.6. Tier 2: Sec. 5.5.2.2.3)  |
| C | NC | (N/A) | U | STRONG COLUMN/WEAK BEAM: The percentage of strong column/weak beam joints in each story of each line of moment frames is greater than 50%. (Commentary: Sec. A.3.1.3.7. Tier 2: Sec. 5.5.2.1.5)  |
| C | NC | (N/A) | U | BEAM PENETRATIONS: All openings in frame-beam webs are less than 1/4 of the beam depth and are located in the center half of the beams. (Commentary: Sec. A.3.1.3.9. Tier 2: Sec. 5.5.2.2.5)   |

**IMMEDIATE OCCUPANCY –  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S4**

Building: PETERSBURG MCMP - LTC ATTIC FRAMING

KPFF Project No.: 1900308

C	NC	(N/A)	U	GIRDER FLANGE CONTINUITY PLATES: There are girder flange continuity plates at all moment-resisting frame joints. (Commentary: Sec. A.3.1.3.10. Tier 2: Sec. 5.5.2.2.6)
C	NC	(N/A)	U	OUT-OF-PLANE BRACING: Beam-column joints are braced out-of-plane. (Commentary: Sec. A.3.1.3.11. Tier 2: Sec. 5.5.2.2.7)
C	NC	(N/A)	U	BOTTOM FLANGE BRACING: The bottom flanges of beams are braced out-of-plane. (Commentary: Sec. A.3.1.3.12. Tier 2: Sec. 5.5.2.2.8)
C	NC	(N/A)	U	COMPACT MEMBERS: All brace elements meet section requirements set forth by AISC 360, Table B4.1. (Commentary: Sec. A.3.3.1.7. Tier 2: Sec. 5.5.4).
C	NC	(N/A)	U	COLUMN SPLICES: All column splice details located in braced frames develop 100% of the tensile strength of the column. (Commentary: Sec. A.3.3.1.3. Tier 2: Sec. 5.5.4.2)
C	NC	(N/A)	U	SLENDERNESS OF DIAGONALS: All diagonal elements required to carry compression shall have $Kl/r$ ratios less than 200. (Commentary: Sec. A.3.3.1.4. Tier 2: Sec. 5.5.4.3)
C	NC	(N/A)	U	CONNECTION STRENGTH: All the brace connections develop the buckling capacity of the diagonals. (Commentary: Sec. A.3.3.1.5. Tier 2: Sec. 5.5.4.4).
C	NC	(N/A)	U	OUT-OF-PLANE BRACING: Braced frame connections attached to beam bottom flanges located away from beam-column joints are braced out-of-plane at the bottom flange of the beams. (Commentary: Sec. A.3.3.1.6. Tier 2: Sec. 5.5.4.5)
C	NC	(N/A)	U	K-BRACING: The bracing system does not include K-braced bays. (Commentary: Sec. A.3.3.2.1. Tier 2: Sec. 5.5.4.6)
C	NC	(N/A)	U	TENSION-ONLY BRACES: Tension-only braces do not comprise more than 70% of the total seismic-force-resisting capacity in structures more than two stories high. (Commentary: Sec. 3.3.2.2. Tier 2: Sec. 5.5.4.7)
C	NC	(N/A)	U	CHEVRON BRACING: Beams in chevron, or V-braced, bays are capable of resisting the vertical load resulting from the simultaneous yielding and buckling of the brace pairs. (Commentary: Sec. A.3.3.2.3. Tier 2: Sec. 5.5.4.6)
C	NC	(N/A)	U	CONCENTRICALLY BRACED FRAME JOINTS: All the diagonal braces frame into the beam-column joints concentrically. (Commentary: Sec. A.3.3.2.4. Tier 2: Sec. 5.5.4.8)
C	NC	(N/A)	U	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than $d/2$ and are anchored into the confined core of the beam with hooks of 135 degrees or more. All coupling beams shall comply with the requirements above and shall have the capacity in shear to develop the uplift capacity of the adjacent wall. (Commentary: Sec. A3.2.2.3. Tier 2: Sec. 5.5.3.2.1)



**IMMEDIATE OCCUPANCY –  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S4**

Building: PETERSBURG MCMP - LTC ATTIC FRAMING  
KPFF Project No.: 1900308

- |   |    |       |   |   |
|---|----|-------|---|---|
| C | NC | (N/A) | U | OVERTURNING: All shear walls shall have aspect ratios less than 4-to-1. Wall piers need not be considered. (Commentary: Sec. A.3.2.2.4. Tier 2: Sec. 5.5.3.1.4)   |
| C | NC | (N/A) | U | CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$ . (Commentary: Sec. A.3.2.2.5. Tier 2: Sec. 5.5.3.2.2) |
| C | NC | (N/A) | U | WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall. (Commentary: Sec. A.3.2.2.6. Tier 2: Sec. 5.5.3.1.5)            |
| C | NC | (N/A) | U | WALL THICKNESS: Thickness of bearing walls is not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 inches. (Commentary: Sec. A.3.2.2.7. Tier 2: Sec. 5.5.3.1.2)                         |

**Diaphragms**

- |   |    |       |   |   |
|---|----|-------|---|---|
| C | NC | (N/A) | U | OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)  |
| C | NC | (N/A) | U | OPENINGS AT FRAMES: Diaphragm openings immediately adjacent to the braced frames or moment frames extend less than 15% of the frame length. (Commentary: Sec. A.4.1.5. Tier 2: Sec. 5.6.1.3)                          |
| C | NC | (N/A) | U | PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. (Commentary: Sec. A.4.1.7. Tier 2: Sec. 5.6.1.4)             |
| C | NC | (N/A) | U | DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5) |
| C | NC | (N/A) | U | DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)  |

**IMMEDIATE OCCUPANCY –  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S4**

Building: PETERSBURG MCMP - LTC ATTIC FRAMING  
KPFF Project No.: 1900308

**High Seismicity**

*(Complete the following items in addition to the items for Very Low, Low, and Moderate Seismicity)*

**Seismic-Force-Resisting System**

- |   |    |       |   |  |
|---|----|-------|---|--|
| C | NC | (N/A) | U | MOMENT-RESISTING CONNECTIONS: All moment connections are able to develop the strength of the adjoining members or panel zones based on 110% of the expected yield stress of the steel per AISC 341, Section A3.2. (Commentary: Sec. A.3.1.3.4. Tier 2: Sec. 5.5.2.2.1)   |
| C | NC | (N/A) | U | COMPACT MEMBERS: All moment and braced frame columns and beams shall meet section requirements set forth by AISC 341, Table D1.1 for highly ductile members. Braced frame beams meet section requirements for moderately ductile members. (Commentary: Sec. A.3.3.1.7 and A.3.3.1.8. Tier 2: Sec. 5.5.2.2.4 and 5.5.4) |
| C | NC | (N/A) | U | CONNECTION STRENGTH: All the brace connections develop the yield capacity of the diagonals. (Commentary: Sec. A.3.3.1.5. Tier 2: Sec. 5.5.4.4)   |

**Connections**

- |   |    |       |   |   |
|---|----|-------|---|---|
| C | NC | (N/A) | U | STEEL COLUMNS: The columns in seismic-force-resisting frames are anchored to the building foundation, and the anchorage is able to develop the least of the tensile capacity of the column, the tensile capacity of the lowest level column splice (if any), or the uplift capacity of the foundation. (Commentary: Sec. A.5.3.1. Tier 2: Sec. 5.7.3.1) |
|---|----|-------|---|---|

## Very Low Seismicity

### **Building System**

#### *General*

C	(NC)	N/A	U	LOAD PATH: The structure shall contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)
(C)	NC	N/A	U	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement need not apply for the following building types: W1, W1A, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)
C	NC	(N/A)	U	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)

#### *Building Configuration*

(C)	NC	N/A	U	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction shall not be less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)
(C)	NC	N/A	U	SOFT STORY: The stiffness of the seismic-force-resisting system in any story shall not be less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)
(C)	NC	N/A	U	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)
(C)	NC	N/A	U	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)
(C)	NC	N/A	U	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)
(C)	NC	N/A	U	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)

**Low Seismicity**      *(Complete the following items in addition to the items for Very Low Seismicity)*

**Geologic Site Hazards**

- |   |  |   |
|---|--|---|
| <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-bottom: 10px;">C</div> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-bottom: 10px;">C</div> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center;">C</div> | NC    N/A    U<br><br>NC    N/A    U<br><br>NC    N/A    U | <p>LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building. (Commentary: Sec. A.6.1.1. Tier 2: Sec. 5.4.3.1)</p> <p>SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: Sec. 5.4.3.1)</p> <p>SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: Sec. 5.4.3.1)</p> |
|---|--|---|

**Moderate and High Seismicity**      *(Complete the following items in addition to the items for Very Low and Low Seismicity)*

**Foundation Configuration**

- |  |                |  |
|--|----------------|--|
| <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-bottom: 10px;">C</div> | NC    N/A    U | <p>OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than <math>0.6S_a</math>. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)</p>               |
| C    NC <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center;">N/A</div>            | U              | <p>TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)</p> |

**IMMEDIATE OCCUPANCY -  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S1 AND TYPE S1A**

Building: PETERSBURG MCMP - HOSPITAL  
KPFF Project No.: 1900308

**Very Low Seismicity**

**Seismic-Force-Resisting System**

- |     |      |     |   |   |
|-----|------|-----|---|---|
| C   | (NC) | N/A | U | <p>DRIFT CHECK: The drift ratio of the steel moment frames, calculated using the Quick Check procedure of Section 4.5.3.1, is less than 0.015. (Commentary: Sec. A.3.1.3.1. Tier 2: Sec. 5.5.2.1.2)</p>   |
| (C) | NC   | N/A | U | <p>COLUMN AXIAL STRESS CHECK: The axial stress caused by gravity loads in columns subjected to overturning forces is less than <math>0.10F_y</math>. Alternatively, the axial stress caused by overturning forces alone, calculated using the Quick Check procedure of Section 4.5.3.6, is less than <math>0.30F_y</math>. (Commentary: Sec. A.3.1.3.2. Tier 2: Sec. 5.5.2.1.3)</p> |
| (C) | NC   | N/A | U | <p>FLEXURAL STRESS CHECK: The average flexural stress in the moment frame columns and beams, calculated using the Quick Check procedure of Section 4.5.3.9 is less than <math>F_y</math>. Columns need not be checked if the Strong Column/Weak Beam checklist item is compliant. (Commentary: Sec. A.3.1.3.3. Tier 2: Sec. 5.5.2.1.2)</p>  |

**Connections**

- |     |    |     |   |   |
|-----|----|-----|---|---|
| (C) | NC | N/A | U | <p>STEEL COLUMNS: The columns in seismic-force-resisting frames are anchored to the building foundation. (Commentary: Sec. A.5.3.1. Tier 2: Sec. 5.7.3.1)</p> |
|-----|----|-----|---|---|

**Low Seismicity**

*(Complete the following items in addition to the items for Very Low Seismicity)*

**Seismic-Force-Resisting System**

- |     |    |     |   |   |
|-----|----|-----|---|---|
| (C) | NC | N/A | U | <p>REDUNDANCY: The number of lines of moment frames in each principal direction is greater than or equal to 2. The number of bays of moment frames in each line is greater than or equal to 3. (Commentary: Sec. A.3.1.1.1. Tier 2: Sec. 5.5.1.1)</p> |
| (C) | NC | N/A | U | <p>INTERFERING WALLS: All concrete and masonry infill walls placed in moment frames are isolated from structural elements. (Commentary: Sec. A.3.1.2.1. Tier 2: Sec. 5.5.2.1.1)</p>   |

**Connections**

- |   |      |     |   |  |
|---|------|-----|---|--|
| C | (NC) | N/A | U | <p>TRANSFER TO STEEL FRAMES: Diaphragms are connected for transfer of seismic forces to the steel frames, and the connections are able to develop the lesser of the strength of the frames or the diaphragms. (Commentary: Sec. A.5.2.2. Tier 2: Sec. 5.7.2)</p> |
|---|------|-----|---|--|

**IMMEDIATE OCCUPANCY -  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S1 AND TYPE S1A**

Building: PETERSBURG MCMP - HOSPITAL  
KPFF Project No.: 1900308

C    **(NC)**    N/A    U    STEEL COLUMNS: The columns in seismic-force-resisting frames are anchored to the building foundation, and the anchorage is able to develop the least of the tensile capacity of the column, the tensile capacity of the lowest level column splice (if any), or the uplift capacity of the foundation. (Commentary: Sec. A.5.3.1. Tier 2: Sec. 5.7.3.1)

**Moderate Seismicity**    *(Complete the following items in addition to the items for Very Low and Low Seismicity)*

**Seismic-Force-Resisting System**

C    **(NC)**    N/A    U    MOMENT-RESISTING CONNECTIONS: All moment connections are able to develop the expected strength of the adjoining members based on the specified minimum yield stress of the steel. (Commentary: Sec. A.3.1.3.4. Tier 2: Sec. 5.5.2.2.1). Note more restrictive requirements for High Seismicity.

**(C)**    NC    N/A    U    PANEL ZONES: All panel zones shall have the shear capacity to resist the shear demand required to develop 0.8 times the sum of the flexural strengths of the girders framing in at the face of the column. (Commentary: Sec. A.3.1.3.5. Tier 2: Sec. 5.5.2.2.2)

C    NC    **(N/A)**    U    COLUMN SPLICES: All column splice details located in moment-resisting frames include connection of both flanges and the web, and the splice develops the strength of the column. (Commentary: Sec. A.3.1.3.6. Tier 2: Sec. 5.5.2.2.3)

**(C)**    NC    N/A    U    STRONG COLUMN/WEAK BEAM: The percentage of strong column/weak beam joints in each story of each line of moment-resisting frames is greater than 50%. (Commentary: Sec. A.3.1.3.7. Tier 2: Sec. 5.5.2.1.5)

C    **(NC)**    N/A    U    COMPACT MEMBERS: All frame elements meet section requirements set forth by AISC 341, Table D1.1, for highly ductile members. (Commentary: Sec. A.3.1.3.8. Tier 2: Sec. 5.5.2.2.4)

**(C)**    NC    N/A    U    BEAM PENETRATIONS: All openings in frame-beam webs are less than  $\frac{1}{4}$  of the beam depth and are located in the center half of the beams. (Commentary: Sec. A.3.1.3.9. Tier 2: Sec. 5.5.2.2.5)

C    **(NC)**    N/A    U    GIRDER FLANGE CONTINUITY PLATES: There are girder flange continuity plates at all moment frame joints. (Commentary: Sec. A.3.1.3.10. Tier 2: Sec. 5.5.2.2.6)

**(C)**    NC    N/A    U    OUT-OF-PLANE BRACING: Beam-column joints are braced out-of-plane. (Commentary: Sec. A.3.1.3.11. Tier 2: Sec. 5.5.2.2.7)

C    **(NC)**    N/A    U    BOTTOM FLANGE BRACING: The bottom flanges of beams are braced out-of-plane. (Commentary: Sec. A.3.1.3.12. Tier 2: Sec. 5.5.2.2.8)

**IMMEDIATE OCCUPANCY -  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S1 AND TYPE S1A**

Building: PETERSBURG MCMP - HOSPITAL  
KPFF Project No.: 1900308

**Diaphragms (Stiff or Flexible)**

- |   |      |       |   |   |
|---|------|-------|---|---|
| C | (NC) | N/A   | U | PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. (Commentary: Sec. A.4.1.7. Tier 2: Sec. 5.6.1.4)     |
| C | NC   | (N/A) | U | DIAPHRAGM REINFORCEMENT AT OPENING: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5) |
| C | NC   | (N/A) | U | OPENINGS AT MOMENT FRAMES: Diaphragm openings immediately adjacent to the moment frames extend less than 15 percent of the total frame length. (Commentary: Sec. A.4.1.5. Tier 2: Sec. 5.6.1.3)               |

**Flexible Diaphragms**

- |   |    |       |   |   |
|---|----|-------|---|---|
| C | NC | (N/A) | U | CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)  |
| C | NC | (N/A) | U | STRAIGHT SHEATHING: All straight sheathed diaphragms shall have aspect ratios less than 1-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)  |
| C | NC | (N/A) | U | SPANS: All wood diaphragms with spans greater than 12 feet consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)  |
| C | NC | (N/A) | U | DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 feet and have aspect ratios less than or equal to 3-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2) |
| C | NC | (N/A) | U | NON-CONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 feet and have aspect ratios less than 4-to-1. (Commentary: Sec. A.4.3.1. Tier 2: Sec. 5.6.3)  |
| C | NC | (N/A) | U | OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)   |

**IMMEDIATE OCCUPANCY -  
STRUCTURAL CHECKLIST FOR  
BUILDING TYPE S1 AND TYPE S1A**

Building: PETERSBURG MCMP - HOSPITAL  
KPFF Project No.: 1900308

**High Seismicity**

*(Complete the following items in addition to the items for Very Low, Low, and Moderate Seismicity)*

**Seismic-Force-Resisting System**

C   ☒ NC   N/A   U   MOMENT-RESISTING CONNECTION: All moment connections are able to develop the strength of the adjoining members or panel zones based on 110 percent of the expected yield stress of the steel per AISC 341, Section A3.2. (Commentary: Sec. A.3.1.3.4. Tier 2: Sec. 5.5.2.2.1)

**Foundation System**

C   NC   ☒ N/A   U   DEEP FOUNDATIONS: Piles and piers are capable of transferring the seismic forces between the structure and the soil. (Commentary: Sec. A.6.2.3)

☒ C   NC   N/A   U   SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story high. (Commentary: Sec. A.6.2.4)



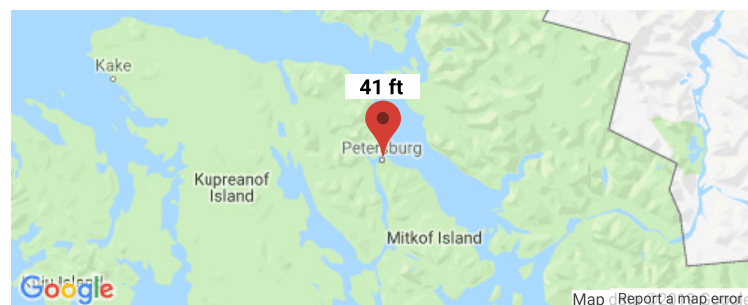
# Appendix C

## Seismic Hazard Data



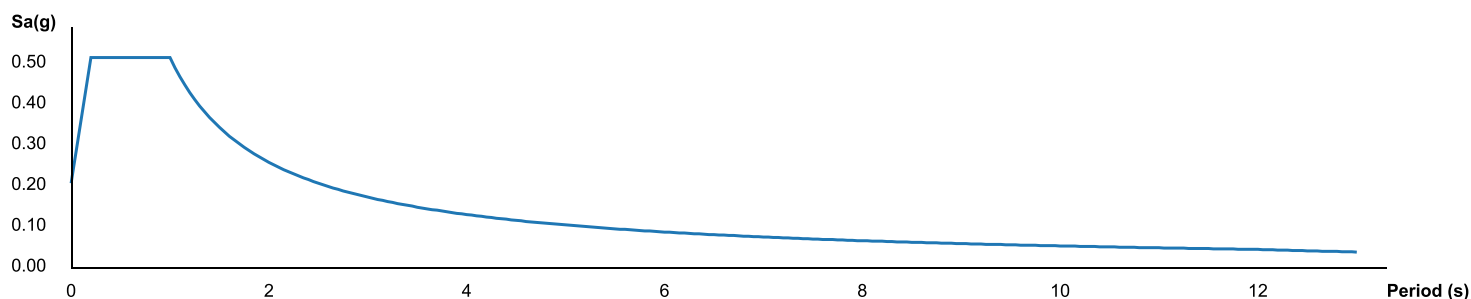
## Search Information

**Coordinates:** 56.8129, -132.9555  
**Elevation:** 41 ft  
**Timestamp:** 2019-07-12T14:27:55.921Z  
**Hazard Type:** Seismic  
**Reference Document:** ASCE41-13  
**Site Class:** D



**Custom Probability:**

### Horizontal Response Spectrum - Hazard Level BSE-2N



### Hazard Level BSE-2N

Name	Value	Description
SsUH	0.249	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
CR <sub>S</sub>	1.144	Coefficient of risk (0.2s)
SsRT	0.285	Probabilistic risk-targeted ground motion (0.2s)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S <sub>S</sub>	0.285	MCE <sub>R</sub> ground motion (period=0.2s)
F <sub>a</sub>	1.572	Site amplification factor at 0.2s
S <sub>XS</sub>	0.448	Site modified spectral response (0.2s)
S1UH	0.27	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
CR <sub>1</sub>	1.03	Coefficient of risk (1.0s)
S1RT	0.278	Probabilistic risk-targeted ground motion (1.0s)
S1D	0.6	Factored deterministic acceleration value (1.0s)
S <sub>1</sub>	0.278	MCE <sub>R</sub> ground motion (period=1.0s)
F <sub>v</sub>	1.844	Site amplification factor at 1.0s
S <sub>X1</sub>	0.513	Site modified spectral response (1.0s)

### Hazard Level BSE-1N

Name	Value	Description
S <sub>XS</sub>	0.299	Site modified spectral response (0.2s)
S <sub>X1</sub>	0.342	Site modified spectral response (1.0s)

### Hazard Level BSE-2E

Name	Value	Description
------	-------	-------------

$S_S$	0.197	$MCE_R$ ground motion (period=0.2s)
$F_a$	1.6	Site amplification factor at 0.2s
$S_{XS}$	0.316	Site modified spectral response (0.2s)
$S_1$	0.203	$MCE_R$ ground motion (period=1.0s)
$F_v$	1.994	Site amplification factor at 1.0s
$S_{X1}$	0.405	Site modified spectral response (1.0s)

### Hazard Level BSE-1E

Name	Value	Description
$S_S$	0.123	$MCE_R$ ground motion (period=0.2s)
$F_a$	1.6	Site amplification factor at 0.2s
$S_{XS}$	0.197	Site modified spectral response (0.2s)
$S_1$	0.114	$MCE_R$ ground motion (period=1.0s)
$F_v$	2.344	Site amplification factor at 1.0s
$S_{X1}$	0.267	Site modified spectral response (1.0s)

### T<sub>L</sub> Data

Name	Value	Description
$T_L$	12	Long-period transition period (s)

*The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.*

### Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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